Can public knowledge contribute to scientific understaning

Science, Mathematics

dingCan lay expertise contribute to scientific knowledge? What are the obstacles? Using Brian Wynne’s Chernobyl work as a case study, assess the possibilities and the perils of welcoming different publics into the scientific sphere. The Science Council recently embarked on a year long project to work out a new definition of science. They claim it is the first ever official definition published: “ Science is the pursuit and application of knowledge and understanding of the natural and social world following a systematic methodology based on evidence" - The science council (2010) The definitions of “ science" and “ scientific knowledge" as based on empirical evidence have important implications for public understanding of what scientific knowledge actually is. Those who are aware of the definition can therefore separate pseudoscientific practices such as homeopathy and astrology and their basis on assumed authority from authentic science. It is this lack of knowledge that is responsible for dangerous medical treatments and epidemics of preventable diseases. Unfortunately many lay people seem unaware, which is a failure on the part of the entire scientific establishment and the mass media. A large obstacle to the public understanding of the basis of scientific knowledge is that scientists are seen by a large proportion of the public to be separated by an intellectual wall, up in their so-called Ivory Tower. They are often seen as elitist, overly specialised, tweed-clad, crusty academics whose research is inaccessible to anyone without a PhD. This stereotype is not helped by the fact that the vast majority of scientific publications are not open to the public sphere. Science that does make it to the public sphere can paint scientists and scientific knowledge in a less than favourable light, creating a huge barrier for scientists to overcome. Dr Ben

Goldacre has been outspoken on this issue in his books and column in the Guardian. Science stories in the press tend to fall into three categories: wacky, breakthrough and scare stories. Wacky stories claim bizarre concepts such as “ watching Richard and Judy will increase your IQ" which, although it might sound benign, serves to give the impression that research money is not going to meaningful science but is being squandered on useless frivolities. Breakthrough stories are usually based on early press releases and a lot of cancer scare stories also fit into this category. Stories gained in this way may be so early that academically they may go nowhere and never be published. Scare stories are far more sinister. The MMR scare was entirely of the media’s making and succeeded not only in endangering vast swathes of children but when the scientific establishment sought to set the record straight by demonstrating the evidence, an artificial controversy was generated which caused a distrust of scientists in the public eye. The Daily Mail has a reputation for causing cancer scares, so much so in fact that one website has referenced all the articles in which the Daily Mail claims something causes or cures cancer and shows the absurd nature of the whole affair (Battley, 2012). The main problem with media science stories is that they do not contain any useful information. The articles are dumbed down to the point where they do not actually contain any science, and have insufficient content to interest the people who might wish to read them, i. e. those that know a little about science. This less than favourable portrayal puts much of the public off science as it gives the impression that scientific knowledge is out of their reach. It is no wonder that vast numbers of the public are convinced that the scientific establishment is part of some form of

conspiracy. Representation of science in the media is a significant source of the mistrust of the scientific community. There have been incidents where scientists have by their apparently aloof and secretive nature isolated themselves from the populations they were supposed to be helping, which has not had a favourable effect on public relations. Brian Wynne analysed the interactions and relationships between hill sheep farmers in the Lake District and a group of scientists. In 1986, fallout from the Chernobyl accident contaminated their flock, which prevented the farmers from selling their sheep. The farmers also received advice about environmental hazards and the possibility of contamination arising from the nearby Sellafield nuclear power plant. The government initially dismissed the effects of the radiation as negligible, but six weeks later a ban was suddenly placed on the movement and slaughter of sheep from several areas, including the Lake District. According to Wynne, the scientists used a series of assumptions when going about their work, some of which ultimately brought about feelings of dislike and distrust among the farmers. The assumption that the purpose of knowledge was control and prediction would have given the scientists the appearance of being disinterested in the hardships inflicted on the farmers and would have therefore created a void between the two groups of people. The assumption that uncertainties in scientific knowledge would be misunderstood if disclosed in public was a huge mistake. The scientists asserted that the caesium levels in the sheep would only last three weeks. After this time they extended the ban indefinitely, making the farmers feel that they had been lied to by scientists. Perhaps if the scientists had been more open about the uncertain nature of such predictions, such

confusing discourse could have been avoided. Scientists working on this project had the arrogance to believe that not only could they successfully simulate the farming conditions practised by the farmers, but they could do this whilst dismissing the farmer’s knowledge as effectively useless. Their arrogance cost them vital information which may have helped to resolve the situation. The main factor that made this incident so damaging was that the hill sheep farmers worked with a tightly controlled environment, which lacked any kind of buffer zone. They were dependant on rearing a large flock of lambs and selling them in the autumn. If the lambs were not sold at this point then the limited quantity of grazing grass would run out and the lambs would starve. The breeding stock that the farmers held was also at risk of starvation, which would blight the farm for years if it was lost. Wynne described the hill sheep farmers as one of the last surviving farming cultures with its own traditions, dialects and recreational pursuits associated with this demanding profession. The scientist’s ignorance of specialist knowledge possessed by the farmers led them to false conclusions that could have been avoided. These had a major knock-on effect on the farmers' fragile lifestyle. The initial conclusion that the problem would only last three weeks and then the further assertion that the farmers should hang on as the contamination would soon dissipate was mostly due to scientists' avoidable ignorance of the local environment. Scientists' knowledge and calculations could have been vastly improved if they had included valuable lay knowledge in their predictions. An example of this expressed by Wynne is the misidentification of the soil type in the area and therefore the behaviour of caesium contamination. The scientists also had little idea of variability between

farms, hill sheep characteristics and difficulties in testing sheep who are used to roaming free and chose to ignore the farmers. The scientists also addressed the radioactive emissions from Sellafield. Previously increased incidence of childhood leukaemia around the plant were investigated and dismissed. Later evidence suggested that the plant’s operator had lied to the investigators with regard to emission levels. Sellafield however was an ethical grey area for the farmers as it was the largest employer in the area and many of their friends and family were working there, so despite major concerns on their part as to Sellafield's contribution to the radioactivity, little was said in public. Research at the time concentrated on the energy signature ratios of the gamma rays emitted in the area, and came to the conclusion that the radiation was in fact from Chernobyl and not the plant. The distribution of the radiation signature was however highly suspicious as it was congregated around Sellafield. Farmers in the area were split and some voiced openly that they thought the scientists and government were taking them for fools and trying to cover up the 1957 fire in the plant. For a time, no data on the radiation levels before Chernobyl was published. Later it was admitted that 50% of the radiation signature was in fact from Sellafield. It was the farmers who observed that the certainties in public announcements are not necessarily backed up by a certainty in the data, farmers who noticed that the Sellafield chimneys joined with the clouds over radioactive hotspots. The farmers were however dismissed by the scientists which may have led to an inadequate investigation. There are lessons to be learned from the terrible handling of this situation. Firstly, scientists should seek to work alongside rather than barge in and assert authority over

families and their livelihoods. Local lay knowledge can be invaluable to scientists, particularly in the practical aspects of experimentation and research, such as how to test live sheep safely and effectively. It is incredibly important that communication between scientists and lay people is open and honest at all times. Finally, scientists should tell people when something is unknown to them instead of making false promises, as the latter course leads to mistrust. The extreme example above of scientists having bad relationships with the public they are working with across the years is only part of the reason that they sometimes have a negative stereotype. The press and television reporting have also played their part, but times are starting to change. Scientists are reaching out to the public in not only communicating their findings but also involving the public in the process. There are three main ways in which the public has bought into the scientific sphere, they can collect data, analyse findings and disseminate the results. This has become known as “ citizen science. " The Citizen Science Alliance puts up various projects that anyone can become involved in, such as Galaxy Zoo, where people identify galaxies based on their shape, with the incentive that they might be the first person ever to look upon that galaxy. The Old Weather Project is where the public help scientists recover Arctic and worldwide weather observations made by United States’ ships since the mid-19th century. These transcriptions contribute to climate model projections and improve our knowledge of past environmental conditions. Historians use their work to track past ship movements and tell the stories of the people on board. Other projects include Planet Hunters, where planets are found by the public by analysing changes in sun brightness and Whale FM, where

participants group similar whale calls together. NASA also has many projects available on their website. Some sceptics have raised concerns about the accuracy of results from untrained individuals but projects work best when patterns are identified by the public and then rendered by the scientists in order to ensure maximum accuracy. Science blogs are a great way in which either the public or an enthusiastic scientist can disseminate scientific knowledge in the public sphere. Blogs have little or no regulation, but those with large readerships are subject to comment from readers. Crowdsourcing is also an interesting new way of getting the public involved in science. Crowdsourcing Discovery at Princeton University has just raised over $25, 000 to look at the effects of methamphetamine on the brain. In return for sponsorship, involvement in the project has been given to the funders as a great way to get involved with science. The history of scientists' relationships with the public is certainly a rocky one, which is well illustrated by the radiation confrontation in the Lake District. The current lack of open access scientific publications and the watered down newspaper science and over-dramatization do not help public opinion. Recent developments in citizen science, crowdsourcing and the development of the scientific blogosphere have shown the public interest in science to be high. Although some scientists are sceptical about untrained people getting involved, the advantages of increasing access should not be underestimated. Not only will it help sponsor and increase manpower for experiments, it may well help tear down the Ivory Tower and help science appeal to people of all backgrounds. http://www. rockethub. com/projects/11106-crowdsourcing-discovery#about-tab http://science. nasa. gov/citizen-scientists/ Bibliography

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